

We claim:

1. A method for managing addresses by a module in a communication system having a plurality of interconnected modules, the method comprising:

5 maintaining an address database including a number of locally owned address entries and a number of remotely owned address entries;

monitoring a status for each of the locally owned address entries in the address database;

10 maintaining the number of locally owned address entries in the address database based upon the status for each locally owned address entry determined by the module;

providing the status for each of the locally owned address entries to the other interconnected modules;

receiving the status for each of the remotely owned address entries from the other interconnected modules; and

15 maintaining the number of remotely owned address entries in the address database based upon the status of each remotely owned address entry provided by the interconnected module associated with the remotely owned address entry.

2. The method of claim 1, wherein:

20 monitoring the status for each of the locally owned address entries comprises detecting a new locally owned address;

maintaining the number of locally owned address entries comprises adding a locally owned address entry for the new locally owned address to the address database; and

25 providing the status for each of the locally owned address entries to the other interconnected modules comprises transmitting a control message to the interconnected modules including the new locally owned address.

3. The method of claim 2, wherein the new locally owned address is associated with an interface supported by the module, and wherein the locally owned address entry includes the
30 new locally owned address and an interface identifier.

4. The method of claim 3, wherein the control message includes a module identifier identifying the module.

5. The method of claim 1, wherein:

5 receiving the status for each of the remotely owned address entries comprises receiving a control message from one of the interconnected modules including an address and a module identifier; and

maintaining the number of remotely owned address entries comprises adding a remotely owned address entry for the address to the address database.

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6. The method of claim 5, wherein the remotely owned address entry includes the address and the module identifier.

7. The method of claim 1, wherein:

15 monitoring the status for each of the locally owned address entries comprises determining that a locally owned address entry is obsolete;

maintaining the number of locally owned address entries comprises purging the obsolete locally owned address entry from the address database; and

20 providing the status for each of the locally owned address entries to the other interconnected modules comprises transmitting a purge message to the interconnected modules including the address from the obsolete locally owned address entry.

8. The method of claim 7, wherein providing the status for each of the locally owned address entries comprises transmitting a keep-alive message to a number of the
25 interconnected modules including a number of addresses from locally owned address entries.

9. The method of claim 1, wherein:

30 receiving the status for each of the remotely owned address entries comprises receiving a purge message from one of the interconnected modules including an address associated with an obsolete remotely owned address entry; and

maintaining the number of remotely owned address entries comprises purging the obsolete remotely owned address entry from the address database.

10. The method of claim 9, wherein maintaining the number of remotely owned address
5 entries further comprises:

maintaining a persistence timer for each remotely owned address entry in the address database; and

purging a remotely owned address entry from the address database when the corresponding persistence timer expires.

10 11. The method of claim 10, wherein:

receiving the status for each of the remotely owned address entries comprises receiving a keep-alive message from one of the interconnected modules including a number of addresses, where each address is associated with an active remotely owned address entry;
15 and

maintaining the number of remotely owned address entries comprises resetting the persistence timer associated with each of said active remotely owned address entries.

12. The method of claim 11, wherein maintaining the number of remotely owned address
20 entries further comprises adding a remotely owned address entry to the address database for an address received in the keep-alive message.

13. The method of claim 12, wherein the remotely owned address entry includes the address and a module identifier identifying the module from which the keep-alive message
25 was received.

14. The method of claim 1, further comprising:

reconfiguring the module to operate in a stand-alone mode; and

purging all remotely owned address entries from the address database upon
30 reconfiguring the module to operate in the stand-alone mode.

15. The method of claim 1, further comprising:
determining that one of the interconnected modules has been removed; and
purging all remotely owned address entries associated with the removed module from
the address database.

16. A module for managing addresses in a communication system having a plurality of interconnected modules, the module comprising:

an address database; and

address maintenance logic operably coupled to maintain a number of locally owned address entries and a number of remotely owned address entries in the address database, wherein the address maintenance logic maintains each locally owned address entry based upon a status determined by the address maintenance logic and maintains each remotely owned address entry based upon a status provided by the interconnected module associated with the remotely owned address entry.

17. The module of claim 16, wherein the address maintenance logic comprises:

detecting logic operably coupled to detect a new locally owned address;

address entry creating logic responsive to the detecting logic and operably coupled to add a locally owned address entry for the new locally owned address to the address database;

and

transmitting logic responsive to the detecting logic and operably coupled to transmit a control message to the interconnected modules including the new locally owned address.

18. The module of claim 17, wherein the new locally owned address is associated with an interface supported by the module, and wherein the locally owned address entry includes the new locally owned address and an interface identifier.

19. The module of claim 18, wherein the control message includes a module identifier identifying the module.

20. The module of claim 16, wherein the address maintenance logic comprises:

receiving logic operably coupled to receive a control message from one of the interconnected modules including an address and a module identifier; and

address entry adding logic operably coupled to add a remotely owned address entry for the address to the address database.

21. The module of claim 20, wherein the remotely owned address entry includes the address and the module identifier.

22. The module of claim 16, wherein the address maintenance logic comprises:

5 monitoring logic operably coupled to determine that a locally owned address entry is obsolete;

purging logic responsive to the monitoring logic and operably coupled to purge the obsolete locally owned address entry from the address database; and

10 transmitting logic responsive to the purging logic and operably coupled to send a purge message to a number of the plurality of interconnected modules including the address from the obsolete locally owned address entry.

23. The module of claim 22, wherein the address maintenance logic further comprises:

15 transmitting logic operably coupled to send a keep-alive message to a number of the interconnected modules including a number of addresses from locally owned address entries.

24. The module of claim 16, wherein the address maintenance logic comprises:

20 first receiving logic operably coupled to receive a purge message from one of the interconnected modules including an address associated with an obsolete remotely owned address entry; and

first purging logic responsive to the first receiving logic and operably coupled to purge the obsolete remotely owned address entry from the address database.

25. The module of claim 24, wherein the address maintenance logic further comprises:

25 timer logic operably coupled to maintain a persistence timer for each remotely owned address entry in the address database; and

second purging logic responsive to the timer logic and operably coupled to purge a remotely owned address entry from the address database when the corresponding persistence timer expires.

26. The module of claim 25, wherein the address maintenance logic further comprises:
second receiving logic operably coupled to receive a keep-alive message from one of
the interconnected modules including a number of addresses; and

timer reset logic responsive to the second receiving logic and operably coupled to
5 reset the persistence timer associated with each of said active remotely owned address entries.

27. The module of claim 26, wherein the address maintenance logic further comprises:
address entry creating logic responsive to the second receiving logic and operably
coupled to add a remotely owned address entry to the address database for an address
10 received in the keep-alive message.

28. The module of claim 27, wherein the remotely owned address entry includes the
address and a module identifier identifying the module from which the keep-alive message
was received.

29. The module of claim 16, further comprising:
reconfiguration logic operably coupled to reconfigure the module to operate in a
stand-alone mode; and
purging logic responsive to the reconfiguration logic and operably coupled to purge all
20 remotely owned address entries from the address database upon determining that the module
has been reconfigured to operate in the stand-alone mode.

30. The module of claim 16, further comprising:
detection logic operably coupled to determine that one of the interconnected modules
25 has been removed; and

purging logic responsive to the detection logic and operably coupled to purge all
remotely owned address entries associated with the removed module from the address
database.

31. The module of claim 16, comprising an Ethernet switching module.

32. The module of claim 16, comprising a slot in a network address translator.
33. The module of claim 16, wherein the address maintenance logic comprises:
means for adding a locally owned address entry to the address database;
means for adding a remotely owned address entry to the address database;
means for maintaining a locally owned address entry in the address database;
means for maintaining a remotely owned address entry in the address database;
means for purging a locally owned address entry from the address database; and
means for purging a remotely owned address entry from the address database.

34. A program product comprising a computer readable medium having embodied therein a computer program for managing addresses by a module in a communication system having a plurality of interconnected modules, the computer program comprising:

address maintenance logic operably coupled to maintain a number of locally owned address entries and a number of remotely owned address entries in an address database, wherein the address maintenance logic maintains each locally owned address entry based upon a status determined by the address maintenance logic and maintains each remotely owned address entry based upon a status provided by the interconnected module associated with the remotely owned address entry.

35. The program product of claim 34, wherein the address maintenance logic comprises:

detecting logic programmed to detect a new locally owned address;

address entry creating logic responsive to the detecting logic and programmed to add a locally owned address entry for the new locally owned address to the address database; and

transmitting logic responsive to the detecting logic and programmed to transmit a control message to the interconnected modules including the new locally owned address.

36. The program product of claim 35, wherein the new locally owned address is associated with an interface supported by the module, and wherein the locally owned address entry includes the new locally owned address and an interface identifier.

37. The program product of claim 36, wherein the control message includes a module identifier identifying the module.

38. The program product of claim 34, wherein the address maintenance logic comprises: receiving logic programmed to receive a control message from one of the interconnected modules including an address and a module identifier; and

address entry adding logic programmed to add a remotely owned address entry for the address to the address database.

39. The program product of claim 38, wherein the remotely owned address entry includes the address and the module identifier.

40. The program product of claim 34, wherein the address maintenance logic comprises:

5 monitoring logic programmed to determine that a locally owned address entry is obsolete;

purging logic responsive to the monitoring logic and programmed to purge the obsolete locally owned address entry from the address database; and

10 transmitting logic responsive to the purging logic and programmed to send a purge message to a number of the plurality of interconnected modules including the address from the obsolete locally owned address entry.

41. The program product of claim 40, wherein the address maintenance logic further comprises:

15 transmitting logic programmed to send a keep-alive message to a number of the interconnected modules including a number of addresses from locally owned address entries.

42. The program product of claim 34, wherein the address maintenance logic comprises:

20 first receiving logic programmed to receive a purge message from one of the interconnected modules including an address associated with an obsolete remotely owned address entry; and

first purging logic responsive to the first receiving logic and programmed to purge the obsolete remotely owned address entry from the address database.

25 43. The program product of claim 42, wherein the address maintenance logic further comprises:

timer logic programmed to maintain a persistence timer for each remotely owned address entry in the address database; and

30 second purging logic responsive to the timer logic and programmed to purge a remotely owned address entry from the address database when the corresponding persistence

timer expires.

44. The program product of claim 43, wherein the address maintenance logic further comprises:

5 second receiving logic programmed to receive a keep-alive message from one of the interconnected modules including a number of addresses; and

timer reset logic responsive to the second receiving logic and programmed to reset the persistence timer associated with each of said active remotely owned address entries.

10 45. The program product of claim 44, wherein the address maintenance logic further comprises:

address entry creating logic responsive to the second receiving logic and programmed to add a remotely owned address entry to the address database for an address received in the keep-alive message.

15 46. The program product of claim 45, wherein the remotely owned address entry includes the address and a module identifier identifying the module from which the keep-alive message was received.

20 47. The program product of claim 34, further comprising:

reconfiguration logic programmed to reconfigure the module to operate in a stand-alone mode; and

25 purging logic responsive to the reconfiguration logic and programmed to purge all remotely owned address entries from the address database upon determining that the module has been reconfigured to operate in the stand-alone mode.

48. The program product of claim 34, further comprising:

detection logic programmed to determine that one of the interconnected modules has been removed; and

30 purging logic responsive to the detection logic and programmed to purge all remotely

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owned address entries associated with the removed module from the address database.

49. A method for synchronizing a plurality of distributed address databases maintained by a plurality of interconnected modules, the method comprising the steps of:

maintaining, by each module, an address database including a number of locally owned address entries and a number of remotely owned address entries;

5 monitoring, by each module, a status for each of the locally owned address entries in the address database;

maintaining, by each module, the number of locally owned address entries in the address database based upon the status for each locally owned address entry determined by the module;

10 providing, by each module, the status for each of the locally owned address entries to the other interconnected modules;

receiving, by each module, the status for each of the remotely owned address entries from the other interconnected modules; and

15 maintaining, by each module, the number of remotely owned address entries in the address database based upon the status of each remotely owned address entry provided by the interconnected module associated with the remotely owned address entry.

50. The method of claim 49, wherein:

20 monitoring the status for each of the locally owned address entries comprises detecting a new locally owned address by a first module of the plurality of interconnected modules;

maintaining the number of locally owned address entries comprises adding a locally owned address entry for the new locally owned address by said first module to the address database;

25 providing the status for each of the locally owned address entries to the other interconnected modules comprises transmitting a control message by said first module to the plurality of interconnected modules including the new locally owned address;

receiving the status for each of the remotely owned address entries comprises receiving the control message by a number of interconnected modules; and

30 maintaining the number of remotely owned address entries comprises adding a

remotely owned address entry for the address by each of said number of interconnected modules to the address database.

51. The method of claim 50, wherein the new locally owned address is associated with an interface supported by said first module, and wherein the locally owned address entry includes the new locally owned address and an interface identifier.

52. The method of claim 51, wherein the control message includes a module identifier identifying the module.

53. The method of claim 52, wherein the remotely owned address entry includes the address and the module identifier.

54. The method of claim 49, wherein:

monitoring the status for each of the locally owned address entries comprises determining by a first module that a locally owned address entry is obsolete;

maintaining the number of locally owned address entries comprises purging the obsolete locally owned address entry by said first module from the address database;

providing the status for each of the locally owned address entries to the other interconnected modules comprises transmitting a purge message by said first module to the plurality of interconnected modules including the address from the obsolete locally owned address entry;

receiving the status for each of the remotely owned address entries comprises receiving the purge message by a number of the interconnected modules, the purge message including the address identifying an obsolete remotely owned address entry in each of said number of interconnected modules; and

maintaining the number of remotely owned address entries comprises purging the obsolete remotely owned address entry by each of said number of interconnected modules from the address database.

55. The method of claim 49, wherein maintaining the number of remotely owned address entries further comprises:

maintaining, by each module, a persistence timer for each remotely owned address entry in the address database; and

5 purging, by each module, a remotely owned address entry from the address database when the corresponding persistence timer expires.

56. The method of claim 55, wherein:

10 providing the status for each of the locally owned address entries to the other interconnected modules comprises transmitting a keep-alive message by a first module to the plurality of interconnected modules including a number of addresses from locally owned address entries;

15 receiving the status for each of the remotely owned address entries comprises receiving the keep-alive message by a number of interconnected modules, where each address is associated with an active remotely owned address entry; and

maintaining the number of remotely owned address entries comprises resetting the persistence timer associated with each of said active remotely owned address entries by each of said number of interconnected modules.

20 57. The method of claim 56, wherein maintaining the number of remotely owned address entries further comprises adding a remotely owned address entry to the address database for an address received in the keep-alive message.

25 58. The method of claim 57, wherein the remotely owned address entry includes the address and a module identifier identifying the module from which the keep-alive message was received.

59. The method of claim 49, further comprising:
reconfiguring a module to operate in a stand-alone mode; and
30 purging all remotely owned address entries from the address database maintained by

said module upon reconfiguring said module to operate in the stand-alone mode.

60. The method of claim 49, further comprising:

removing one of the interconnected modules;

5 detecting the removed module by each of the other interconnected modules; and

purging, by each of said other interconnected modules, all remotely owned address entries associated with said removed module from the address database.

61. A communication system comprising a plurality of interconnected modules, wherein each module maintains an address database including a number of locally owned address entries and a number of remotely owned address entries, and wherein each module maintains each of its locally owned address entries based upon a status of each locally owned address entry determined by the module and maintains each of its remotely owned address entries based upon a status of each remotely owned address entry provided by the interconnected module associated with the remotely owned address entry.

62. The communication system of claim 61, wherein each module comprises:
an address database; and
address maintenance logic operably coupled to maintain a number of locally owned address entries and a number of remotely owned address entries in the address database, wherein the address maintenance logic maintains each locally owned address entry based upon a status determined by the address maintenance logic and maintains each remotely owned address entry based upon a status provided by the interconnected module associated with the remotely owned address entry.

63. The communication system of claim 62, wherein the address maintenance logic comprises:
detecting logic operably coupled to detect a new locally owned address;
address entry creating logic responsive to the detecting logic and operably coupled to add a locally owned address entry for the new locally owned address to the address database;
and
transmitting logic responsive to the detecting logic and operably coupled to transmit a control message to the interconnected modules including the new locally owned address.

64. The communication system of claim 63, wherein the new locally owned address is associated with an interface supported by the module, and wherein the locally owned address entry includes the new locally owned address and an interface identifier.

65. The communication system of claim 64, wherein the control message includes a module identifier identifying the module.

5 66. The communication system of claim 62, wherein the address maintenance logic comprises:

receiving logic operably coupled to receive a control message from one of the interconnected modules including an address and a module identifier; and

address entry adding logic operably coupled to add a remotely owned address entry for the address to the address database.

10 67. The communication system of claim 66, wherein the remotely owned address entry includes the address and the module identifier.

15 68. The communication system of claim 62, wherein the address maintenance logic comprises:

monitoring logic operably coupled to determine that a locally owned address entry is obsolete;

purging logic responsive to the monitoring logic and operably coupled to purge the obsolete locally owned address entry from the address database; and

20 transmitting logic responsive to the purging logic and operably coupled to send a purge message to a number of the plurality of interconnected modules including the address from the obsolete locally owned address entry.

25 69. The communication system of claim 68, wherein the address maintenance logic further comprises:

transmitting logic operably coupled to send a keep-alive message to a number of the interconnected modules including a number of addresses from locally owned address entries.

30 70. The communication system of claim 62, wherein the address maintenance logic comprises:

first receiving logic operably coupled to receive a purge message from one of the interconnected modules including an address associated with an obsolete remotely owned address entry; and

5 first purging logic responsive to the first receiving logic and operably coupled to purge the obsolete remotely owned address entry from the address database.

71. The communication system of claim 70, wherein the address maintenance logic further comprises:

10 timer logic operably coupled to maintain a persistence timer for each remotely owned address entry in the address database; and

second purging logic responsive to the timer logic and operably coupled to purge a remotely owned address entry from the address database when the corresponding persistence timer expires.

15 72. The communication system of claim 71, wherein the address maintenance logic further comprises:

second receiving logic operably coupled to receive a keep-alive message from one of the interconnected modules including a number of addresses; and

20 timer reset logic responsive to the second receiving logic and operably coupled to reset the persistence timer associated with each of said active remotely owned address entries.

73. The communication system of claim 72, wherein the address maintenance logic further comprises:

25 address entry creating logic responsive to the second receiving logic and operably coupled to add a remotely owned address entry to the address database for an address received in the keep-alive message.

74. The communication system of claim 73, wherein the remotely owned address entry includes the address and a module identifier identifying the module from which the keep-alive message was received.

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75. The communication system of claim 62, further comprising:
reconfiguration logic operably coupled to reconfigure the module to operate in a
stand-alone mode; and
purging logic responsive to the reconfiguration logic and operably coupled to purge all
5 remotely owned address entries from the address database upon determining that the module
has been reconfigured to operate in the stand-alone mode.

76. The communication system of claim 62, further comprising:
detection logic operably coupled to determine that one of the interconnected modules
10 has been removed; and
purging logic responsive to the detection logic and operably coupled to purge all
remotely owned address entries associated with the removed module from the address
database.

15 77. The communication system of claim 61, comprising an Ethernet switch having a
plurality of interconnected Ethernet switching modules.

78. The communication system of claim 77, wherein the Ethernet switch is a single
manageable switching node supporting a single address space.

20 79. The communication system of claim 61, comprising a network address translator
having a plurality of interconnected slots.